

2883

**RESPONSE TO THE OEPA COMMENTS
OPERABLE UNIT 4 TREATABILITY STUDY
WORK PLAN FOR THE VITRIFICATION OF THE
RESIDUES FROM SILOS 1, 2, AND 3**

X/X/XX

9

ENCLOSURE

Response to the OEPA Comments
Operable Unit 4 Treatability Study Work Plan
for the Vitrification of the Residues
from Silos 1, 2, and 3

2883

General Comments

1. Ohio EPA Comment: The discussion of vitrification in the work plan is too general. Also, several portions of the treatability study are not described at all. The work plan must include procedures and methods for off-gas collection during vitrification, determining the composition of the off-gas, determining the amount of radon emanated during vitrification, determining the emanation rate of radon from the vitrified residues, separating moisture from the off-gas, the modified TCLP, and measuring volume reduction.

Response: Will modify. A figure will be added identifying the equipment that will be used. The equipment list in Section 5.0 will be expanded. Reference to procedures will be added to Section 3.3. Non-standard procedures are in the process of being developed and will be submitted when available.

2. Ohio EPA Comment: The work plan is not consistent with the Treatability Study Work Plan for Operable Unit 4 (10/5/91). The vitrification treatability study work plan omits tests which will be done on the final solidified waste from cementation. Additional tests which should be conducted on the final vitrification waste form include 5-day Static Leach test, Durability tests (recommended by Ohio EPA 11/5/91), bulking factor, unconfined compressive strength, shear strength, permeability, etc.. In order to perform a competent comparative analysis in the Feasibility Report, the tests conducted on all final waste forms should be the same.

Response: No change required. Vitrification of radioactive waste has been identified as a Best Demonstrated Available Technology (BDAT). Tests related to the long-term stability of the vitrified waste form will not be performed because durability was established when vitrification was promulgated as BDAT.

Specific Comments

1. Ohio EPA Comment: Page 1, line 32: Radium levels are quite high. No special monitoring or concerns are identified in this report. Due to the carcinogenic nature of radium, containment of the off-gases (radon, in particular) should be addressed in detail in this work plan.

Response: No change required. Collection of off-gases will not be required due to determining the radon emanation utilizing an open system. All work will be performed in a fume hood.

2. Ohio EPA Comment: Section 1.2, page 2, 2nd bullet: Correct sentence from "hazardous chemical" to read "...hazardous substances."

2883

Response: Will modify.

3. Ohio EPA Comment: Section 1.3.1, page 3, lines 20-23: Objectives for the treatability study must include a reduction in the leachability of radionuclides and a reduction in the radon emanation rate as well as a reduction in the radon emanation rate as well as a reduction in the leachability of hazardous substances. The primary goal of these treatability studies should be to develop a stable waste form with minimal leachability of all contaminants.

Response: Will modify. A test will be added to determine the leachability of radionuclides from the treated waste form.

4. Ohio EPA Comment: Page 3, lines 27 and 33: There have been two failures using vitrification technology. One of these was a soil column at the N Reactor. The PNL model used at Hanford's N Reactor did not correctly assess the amount of off-gassing or the volume expansion of the melt. What has PNL done to correct their model to estimate these procedures for the vitrification process?

Response: No change required. Vitrification does reduce volume. The expansion of soil at Hanford mentioned in the question refers to in-situ vitrification. The type of vitrification proposed for K-65 material is unrelated to in-situ vitrification in that the volume of material is controlled by the rate of material flow to the melter. In-situ vitrification is, in contract, a more uncontrolled technology. The size of the melt is limited by the amount of heat, the supply of material (in-situ) is essentially limitless. To compare the vitrification technology proposed for K-65 material with that of in-situ in regard to melt size is not correct.

5. Ohio EPA Comment: Page 3, Lines 32 and 33: Define the chemistry of the metal oxide residue in more detail.

Response: Will modify. An appendix will be added that will include the available characterization data.

6. Ohio EPA Comment: Page 3, line 38: Frequently, the off-gases from vitrification are quite corrosive. PNL should measure for strong acid radicals like NO-, CL-, and SO =. These ions can cause severe corrosion in the gas collection system if the proper materials of construction are not used.

Response: No change required. During laboratory screening, thorough chemical analyses will be performed to the untreated waste to determine whether these radicals will be in the off-gas.

7. Ohio EPA Comment: Section 1.3.1, page 3, lines 41-43: Include "Characteristics of Fernald's Silos 1 and 2 Residue Before, During and After Vitrification" in the list of references. DOE should incorporate this report into the document by adding it as an attachment. The report contains information which would be helpful in understanding the proposed methods. 2883

Response: No change required. Copies of the report will be transmitted to U.S. EPA and Ohio EPA.

8. Ohio EPA Comment: Section 1, Figure 1-1, page 4: In addition to MCLs as Remedial Action Objectives, non-zero MCLGs should be included. The NCP's support of MCLGs has been previously emphasized by Ohio EPA in our comments on a number of documents.

Response: Will modify Figure 1-1.

9. Ohio EPA Comment: Page 7, line 4: All other acidic ions and radionuclides in the off-gas must also be measured in order to develop a material balance for this process. Material balance considerations, i.e., chemical composition, temperature, flow rate; must also be included in the testing program.

Response: No change required. Assessing material balance considerations will be performed during remedy design.

10. Ohio EPA Comment: Section 1.3.1, page 7, lines 8-11: a) Reference the source for EPA limit of 20 pCi/m²-s. b) The calculations for the conversion for 48 pCi/hr to 1.56 pCi/m²-s, should be in an appendix.

Response:

- a) Will modify. Reference to 40 CFR Part 61 Subpart Q will be added.
- b) No change required. 48 pCi/hr to 1.56 pCi/m²-s is as reported in the laboratory report from the previous vitrification tests. Calculations for the conversion is not relative to the goals of the treatability studies.

11. Ohio EPA Comment: Page 8, Table 1-1, line 7: Define Other Ions - 3.4%.

Response: No change required. This is data as reported from the previous vitrification tests. It was not defined in the laboratory report issued.

12. Ohio EPA Comment: Page 11, line 13: Define metal oxide technology.

Response: No change required. There is no reference to "metal oxide technology" on page 11.

13. Ohio EPA Comment: Page 13, line 7: Please define what constitutes a "successful" vitrification run. What parameters are measured to indicate a "successful" run? 2883

Response: Will modify. A paragraph will be added defining PNL's specific criteria.

14. Ohio EPA Comment: Section 1.3.4, page 13, lines 12-15: Specify that the independent laboratory is an approved laboratory for analysis under the QAPP by U.S. EPA.

Response: Will add.

15. Ohio EPA Comment: Section 1.3.4, page 13, lines 18-20: The discussion of activities related to the liquid collected from the off-gas should be included in Section 4 of the work plan.

Response: Will add bullet in Section 4.2.

16. Ohio EPA Comment: Page 13, line 19: How will the liquid and condensate be treated in the pilot studies? This issue is glossed over in the report.

Response: No change required. This work plan does not and will not address pilot studies. Which treatment technology to be carried forth into pilot studies is yet to be determined. It is anticipated for the vitrification technology, the condensate will be recycled through the vitrification process.

17. Ohio EPA Comment: Page 13, line 40: See previous comment.

Response: No change required. See comment above.

18. Ohio EPA Comment: Section 2.0, page 15, line 11: Change the typographical error "on" or "or".

Response: Will change to "and".

19. Ohio EPA Comment: Page 15, line 11: Does vitrification actually reduce volume? Field test at Hanford showed that the soil column actually expanded about 10% across the base of the melt. Fernald - DOE should obtain test results from DOE - Hanford on the vitrification tests conducted in April 1990 at an N Reactor soil column. 4

Response: No change required. Vitrification does reduce volume. The expansion of soil at Hanford mentioned in the question refers to in-situ vitrification. The type of vitrification proposed for K-65 material is unrelated to in-situ vitrification

in that the volume of material is controlled by the rate of material flow to the melter. In-situ vitrification is, in contract, a more uncontrolled technology. The size of the melt is limited by the amount of heat, the supply of material (in-situ) is essentially limitless. To compare the vitrification technology proposed for K-65 material with that of in-situ in regard to melt size is not correct.

2883

20. Ohio EPA Comment: Page 17, line 7: How will water be treated from Hydraulic Removal Unit?

Response: No change required. To be determined during remedy design.

21. Ohio EPA Comment: Page 18, line 6: See previous comment.

Response: No change required. To be determined during remedy design.

22. Ohio EPA Comment: Page 19, Figure 2-3: Flowsheet does not agree with description on page 16. Adjust write-up to accurately reflect process shown in Figure 2-3.

Response: No change required. Description on page 16 and Figure 2-3 are as described in the Initial Screening of Alternatives document approved in October, 1990.

23. Ohio EPA Comment: Section 3.1, page 23, line 23: State in the text that the primary waste streams are the K-65 waste and the metal oxide waste.

Response: Will clarify.

24. Ohio EPA Comment: Section 3.1, page 23: Durability tests should be conducted on the final waste form. The following are justifications for these tests:

- a) Through failure mechanisms such as: desiccation cracks, slope instability, settlement, piping, penetration, erosion cold climate, earthquakes, and construction errors, water can permeate through the facility. Therefore, the waste can become saturated causing the stabilized waste to erode and possibly contaminate the surrounding area. In order to determine what waste matrix is the most durable, a wetting and drying test is needed.
- b) The K-65 waste has a life expectancy over 1000 years. There is no data on the structural longevity of the low level waste facility. Since this remediation is to be a permanent solution, a durability test (resistance to degradation) would provide data to help choose the most durable solidified waste matrix.

Response: No change required. Vitrification of radioactive waste has been identified as a Best Demonstrated Available Technology (BDAT). Tests related to the long-term stability of the vitrified waste form will not be performed because durability was established when vitrification was promulgated as BDAT.

2883

25. Ohio EPA Comment: Section 3.1, page 23: This vitrification treatability study should at least include the same test and data quality objectives as the cementation treatability study. The following test should also be included: bulking factor, unconfined compressive strength of 500 psi, shear strength, permeability, and durability tests.

Response: No change required. See above response.

26. Ohio EPA Comment: Page 26, lines 4 and 5: Anions should be completely identified in off-gas for material balance.

Response: No change required. During laboratory screening, thorough chemical analyses will be performed to the untreated waste to determine whether anions will be in the off-gas.

27. Ohio EPA Comment: Page 27, line 13: Metal oxide composition should be developed in earlier stages of the work plan.

Response: No change required. Laboratory screening of the metal oxide material is briefly discussed in Section 1.4.3.

28. Ohio EPA Comment: Section 4.1, page 27, lines 15-18: The gamma scan and the list of analytes in Table 4-3 does not include all radionuclide isotopes present in the waste. One of the objectives listed for laboratory screening is to determine the concentration of radioactive isotopes in the wastes (see Section 3.1, page 23, lines 25-26). Describe how this objective will be accomplished.

Response: Will modify. Any radiological analyses to be performed as part of this treatability study will be consistent with the contaminants of concern as listed in the RI/FS Risk Assessment Work Plan.

29. Ohio EPA Comment: Section 4.1, Table 4-3, page 29: There are numerous discrepancies between the list of isotopes in this treatability study and the risk assessment work plan. In the draft Risk Assessment Work Plan (10/15/91), Table 4-2 list radionuclides and hazardous chemicals in environmental media or operable unit source terms. Radionuclides that were listed in the risk assessment but are not included in this treatability study are as follows: Actinium-227, Radium-228, Radon-220, Radon-222, Thorium-228, Thorium-232, Uranium-234, Uranium-235/236, and Uranium-228. Radionuclides that were listed in this treatability study but are not included in the risk assessment are as follows: Radium-223, Thorium-227, Lead-211, Lead-214, Bismuth-214, and Radon-219. DOE needs to discuss

how it will address/assess these additional radionuclides in this treatability study. Additionally, DOE must develop a comprehensive/complete list of radionuclides for the specific operable units and be consistent in their use.

2883

Response: Will modify. See above comment response.

30. Ohio EPA Comment: Section 4.1, Tables 4-1 and 4-2: Explain how these lists of analytes were selected.

Response: Will clarify. The analytes listed in Tables 4-1 and 4-2 are that specific elements that affect the feasibility of the vitrification technology.

31. Ohio EPA Comment: Section 4.2, page 30, lines 23-26: Define "open system". In lines 29-30, define "partial system".

Response: Will change. "Partial" will be changed to "open".

32. Ohio EPA Comment: Section 4.2, page 32, Figure 4-1: Define "PNL criteria" and provide more information on what this encompasses.

Response: Will modify. A paragraph will be added defining PNL's specific criteria.

33. Ohio EPA Comment: Section 4.2.2, page 33: This section and the following ones should include tables defining the amounts and mixtures of "glass forming reagents" to be added. This information is essential to understanding the mechanism of the treatments as well as additional volumes which may be added to the waste stream.

Response: Will modify. Previous vitrification testing utilized reagent grade NaOH for the vitrification of K-65 residues.

Amounts and mixtures of "glass forming reagents" will be defined after evaluating the results of the laboratory screening.

34. Ohio EPA Comment: Section 4.2.3, page 33: This section must define the ratios of bento-grout to be used during the vitrification tests. This comment and the previous one are asking for no more data than were provided in the cementation treatability study work plan.

Response: No change required. Table 4-4 for Sequence B identifies the ratio of 50/50 as maximum. Due to the limited amount of K-65 material, the number of screening tests must be limited. Results of the laboratory screening will be used to determine the specific ratio.

35. Ohio EPA Comment: Page 34, line 7: Fernald should obtain a copy of PNL's vitrification procedures and criteria. The author of the work plan seems to have implicit faith in PNL. Someone at Fernald DOE should become familiar with PNL data so that the data may be properly evaluated and challenged when necessary. 2883

Response: Will modify. A paragraph will be added defining PNL's specific criteria.

36. Ohio EPA Comment: Page 34, line 22: What is the rationale of mixing K-65 and metal oxide materials for vitrification?

Response: Will add new paragraph. The mixture of Silo 3 and K-65 material has been proposed for the purpose of reducing costs of remediation.

37. Ohio EPA Comment: Page 35, line 20: What is "satisfactory" as related to Test 9? What criteria are used to determine this?

Response: Will modify. Satisfactory is identified on page 35, lines 4-6, meeting the PNL specific criteria for vitrification and acceptable results from the modified TCLP. PNL specific criteria will be identified.

38. Ohio EPA Comment: Page 36, line 24: Add condenser to remove moisture.

Response: Will add.

39. Ohio EPA Comment: Page 39, line 7: What geochemical models are going to be used?

Response: No change required. Please refer to the RI/FS Risk Assessment Work Plan.

40. Ohio EPA Comment: Page 40, line 14: Add power consumption meter.

Response: No change required. Determining power consumption is not an issue in determining the feasibility of the vitrification technology. This data should be collected during pilot scale testing.

41. Ohio EPA Comment: Page 40, line 37: Add power consumption meter.

Response: No change required. See above response.

42. Ohio EPA Comment: Page 41, line 34: Add total power consumption, kilowatt hours. 2883

Response: No change required. See above response.

43. Ohio EPA Comment: PNL-MA-70, QA Plan, Exhibit A, C.: C. Chapman should have a direct technical interface with PNL to fully understand the vitrification test data.

Response: No change required. C. C. Chapman is the Group Leader of Applied Melter Technologies at PNL.

44. Ohio EPA Comment: PAP-70-404, Rev. 1, C. Reports: PNL should explain all technical data generated and how it relates to vitrification.

Response: No change required. RI/FS process requires a Treatability Study Report. See Section 11.0.

45. Ohio EPA Comment: PAP-70-404, Rev. 1, D. Records: Add section of off-gas test procedure.

Response: Will modify Section 3.0. Non-standard procedures are in the process of being developed by PNL and will be submitted when available.